**Do not rely solely on this work sheet!** Make sure to study homework problems, other work sheets, lecture notes, and the book!!!

1. Section 3.4

   (a) Describe the transformations that transform the graph of $y = x^3$ to the graph of $y = -2(x - 5)^3 - 2$

   (b) For each of the following graphs $f(x)$ is the solid line and $g(x)$ is the dashed line. Describe the transformations that transform the graph of $f(x)$ into the graph of $g(x)$.
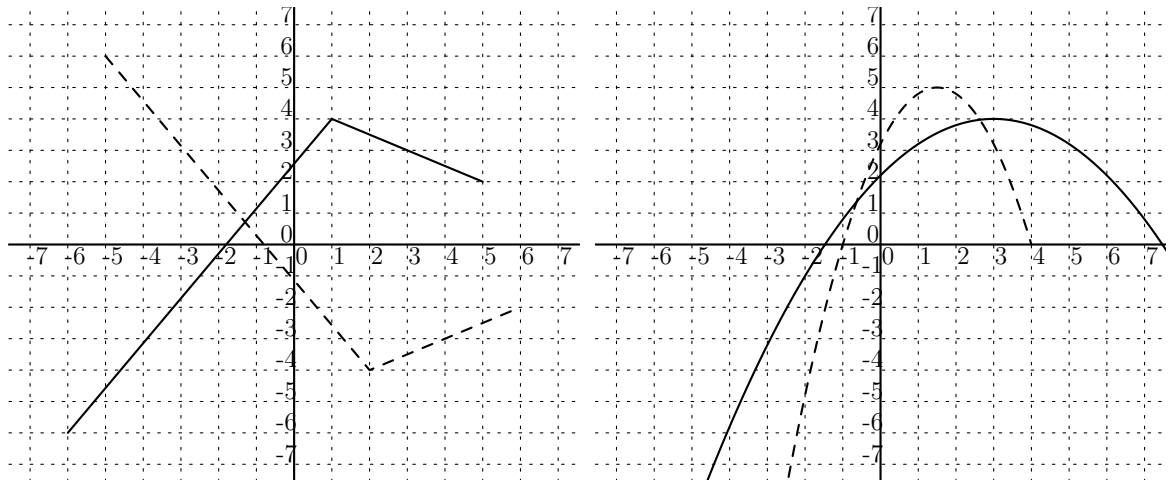
2. Section 3.5

   (a) Find the composition $f(g(x))$ for the functions $f(x) = \sqrt{x + 1}$ and $g(x) = x^2 - 1$.

   (b) For the functions $g(x) = \dfrac{1}{x}$ and $f(x) = \dfrac{1}{x}$, find the composition $g(f(x))$ and simplify. State the domain of the composition.

   (c) Car A leaves a point at 8:00am traveling due north at 50mi/hr. Car B leaves the same point at the same time traveling due east at 60mi/hr. Find the distance between the cars at time as a function of time t.

3. Section 3.7

   (a) Determine which of the functions $f(x) = x^2 - 3x + 1$, $f(x) = x^3 - 5$, and $f(x) = \sqrt{x+3}$ are one-to-one. (A graphing calculator may be useful.)

   (b) Find the inverse function $f^{-1}(x)$ for $f(x) = \dfrac{x-1}{x+2}$.

   (c) Find the inverse of $g(x) = 2x^3 + 5$.

   (d) Use composition to show that $f(x) = 2x - 3$ and $g(x) = \dfrac{x+3}{2}$ are inverses of each other.

4. Section 4.1

   (a) Find the maximum value of the function $f(x) = -3x^2 + 10x + 4$.

   (b) A farmer has 1600 feet of fence to build a rectangular pen. What dimensions should he make the pen to maximize the area enclosed by the pen?

   (c) Describe the transformations that could be applied to the graph of $f(x) = x^2$ to obtain the graph of $g(x) = -4x^2 - 8x + 3$

   (d) Find the equation of the unique quadratic function that has a vertex at the point $(-2, 5)$ and an x-intercept of -1.

5. Section 4.2

   (a) Evaluate $\dfrac{x^3 - 2x^2 + x - 2}{x - 4}$ and express the result in the form $P(x) = D(x)Q(x) + R(x)$.

   (b) Use the remainder from the above problem to decide if $x - 4$ is a factor of $x^3 - 2x + x - 2$ and to find $P(4)$.

   (c) What is the remainder when $f(x) = 2x^{90} - 5x^{70} - 3x^{15} + 7$ is divided by $x + 1$?

   (d) Completely factor $f(x) = x^3 - x^2 - 2x + 2$ by using a calculator to find one root and long division to find the others. Factors should be exact.

   (e) What is the maximum number of roots of the polynomial $P(x) = 5x^3 + 4x^5 - 3x + 1.2$?

6. Section 4.4

   (a) Determine the end behavior of $f(x) = -3x^5 + 2x^2 - 5$.

   (b) Determine the end behavior of $f(x) = 3x^6 + 2x^2 - 5$.

   (c) Sketch the graph of $f(x) = (x-1)^2(x+3)(x-5)$.

   (d) Which one of the following statements is false

      i. The graphs of all polynomials are continuous.
      ii. The graphs of all polynomials are smooth.
      iii. The graph of a polynomial may have a vertical asymptote.
      iv. The graph of a polynomial never contains a sharp corner.
      v. The domain of any polynomial is $(-\infty, \infty)$.

   (e) Use a graphing calculator to find the local extrema of the function $f(x) = 3x^4 - 8x^3 - 6x^2 + 24x + 1$

7. Section 4.5

   (a) Describe the end behavior of the graph of $f(x) = \dfrac{3x^3 - 4x^2 - 5}{2x^3 - 5x + 1}$

   (b) Sketch the graph of the function $\dfrac{x-1}{x^2 + 5x - 6}$. Label the vertical and horizontal asymptotes, holes, x-intercepts, y-intercepts and describe the end behavior.

8. Section 4.6

   (a) Find the solutions to the inequality. Express you answer in interval notation.

   $$(x-1)(x+2)(x-4) \le 0$$

   (b) Find the solutions to the inequality. Express you answer in interval notation.

   $$\frac{2}{x-3} \ge \frac{3}{x-1}$$

   (c) Verify the solution to the previous problem graphically.

9. Section 4.7

   (a) Perform the operation and express answer in standard complex form $(4+i)(2-3i)$

   (b) Perform the operation and express answer in standard complex form $(2-3i)^2$

   (c) Solve the quadratic equation $x^2 + 3x + 8 = 0$ and express answer in standard complex form.

   (d) Write the number $\dfrac{1}{2-i}$ in standard complex form (rationalize the denominator).

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10. Section 5.1

(a) Simplify, and write the exact answer (do not approximate): $\sqrt{150} + \sqrt{24}$

(b) Simplify the expression $\dfrac{(b^x)^{x-1}}{b^{-x}}$

(c) Perform the operation and simplify $(\sqrt{x} + y)^2$

(d) Simplify the expression $\sqrt{\sqrt[3]{\sqrt{a^3 b^4}}}$ without using radicals

(e) Rationalize the numerator of the expression $\dfrac{\sqrt{y} - 5}{10}$.

11. Section 5.2

(a) A population of bacteria doubles every two hours. If there is initially 1000 bacteria present, write a function that expresses the total number of bacteria P, after t hours.

(b) If a certain radioactive substance decays with decay constant $r=0.0015$, how much of 100 grams of the substance will be left after two years?

(c) If \$5,000 is deposited in a bank account which has a yearly interest rate of $r = 2.5\%$ compounded continuously, find how much is in the account after 2.5 years.

(d) How long until \$10,000 doubles in a bank account with a yearly interest rate of $r = 7\%$ compounded continuously?

12. Section 5.3

(a) Convert $x^{-3} = \left(\dfrac{1}{64}\right)$ to an equivalent logarithmic statement.

(b) Convert $\log_2(\dfrac{1}{32}) = x$ to an equivalent exponential statement.

(c) Find the domain of $f(x) = \ln(x^2 + 3x + 2)$

(d) Solve for x exactly.
$$\log_2(x - 1) = 3$$

(e) Solve for x exactly.
$$e^{2x-3} = 4$$

(f) Use a graphing calculator to solve the equation for x. Express answer to three decimal places.
$$\ln(x) + 4 = 5^x$$

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